

REMARKS

Claim 1 has been amended to replace the term "parasites" with "acaracides". Support for this amendment can be found throughout the specification, for example, page 1, second paragraph. Claim 10 has been amended to remove the narrower limitation to the benzoxazin type safener. No new matter has been added.

The present invention relates to a herbicidal synergistic composition for the selective control of broad-leaved weeds and grasses in crops made resistant to protoporphyrinogen oxidase inhibitors comprising as active compounds a mixture of

- a) a herbicide which inhibits the action of protoporphyrinogen oxidases in plants (= protoporphyrinogen oxidase inhibitors = PPO inhibitors) and
- b) at least one further pesticide selected from the group consisting of co-herbicides, fungicides and insecticides/acaracides,

which protects the useful genetically transformed crop plants but not the weeds from the phytotoxic action of the herbicidal composition.

As mentioned on page 1, fourth paragraph of the specification, the PPO inhibitors under a) and the co-herbicides under b) useful in the present composition are known. The essential feature of instant invention therefore is to provide a composition of defined PPO inhibitors a) and at least one known pesticide e.g. a co-herbicide b) which composition when applied to PPO inhibitor resistant crops leads to synergistically improved and economically relevant toxic effects to said pest organisms, e.g., phytotoxic effects against unwanted weeds, without being harmful to the useful crop plants simultaneously, i.e., without leading to comparable synergistically enhanced phytotoxic effects on the PPO inhibitor resistant crop plants.

Claim 10 has been rejected under 35 U.S.C. §112, second paragraph as being indefinite for containing a narrower statement of the range/limitation. Accordingly, Applicant has amended claim 10 to remove the narrower limitation of the benzoxazin type safener, thus rendering the rejection moot.

Claims 1-20 have been rejected under 35 U.S.C. §103(a) as allegedly obvious over Sato et al (US 6,127,318) in view of Volrath et al (US 6,084,155) and Devine et al (Physiology of Herbicide Action, p. 152-163 (1993)). Applicants respectfully traverse.

Sato et al. disclose a composition comprising glyphosate or a salt thereof and a triazolinone herbicide, in particular carfentrazone-ethyl and sulfentrazone which both are PPO inhibitors for post-emergence control of a broad spectrum of weeds.

The purpose of Sato et al. is to provide a formulation comprising glyphosate or a salt thereof, a triazolinone herbicide and a surfactant, the technical improvement of which is first glyphosate as a broad-spectrum herbicide can supplement the triazolinone and the combination can control a wider spectrum of weed species than the triazolinone herbicide can control alone, and second the early symptoms caused by the triazolinone can serve as an early marker indicating whether a given plant has been treated with the combination (column 2, lines 11-19).

However, Sato et al. give no direction at all for the one skilled in the art to two essential features of instant application in that said document is silent on compositions comprising PPO inhibitors and at least one co-herbicide which when applied to PPO inhibitor resistant crops are leading to synergistically improved phytotoxic effects towards unwanted weeds without leading to similar synergistically enhanced phytotoxic effects on the PPO inhibitor resistant crop plants simultaneously. This reference fails to suggest any surprising, unexpected effects associated with the combined use of such herbicides.

As additional support for the above statements, the percent inhibition measured for the individual components glyphosate and carfentrazone-ethyl and of their combinations as disclosed in Tables 3-22 in columns 25-33 of Sato et al. have been taken to compare the expected herbicidal activity calculated according to the Colby formula with the percent inhibition measured as disclosed in said Tables. Apart from a few examples only with weak synergistic effects, the comparison revealed no clear-cut synergism at the measured application rates and at different DAT (days after treatment) on the weeds used in the Examples. Moreover, no crop species let alone PPO inhibitor tolerant crops are involved in these tests.

Volrath et al. disclose DNA sequences coding for protox enzymes from different crops such as soybean, maize, wheat, cotton etc. This document further teaches modified forms of protox enzymes that are herbicide tolerant and the production of plants expressing said modified forms of protox enzymes via mutation of native protox gene to a resistant form or via standard recombinant DNA and molecular cloning techniques with a gene encoding a herbicidal tolerant form of a plant protox enzyme.

Further, in columns 37-44 of this document different structural classes of protox inhibitors of naturally occurring protox enzyme and the most prominent representatives thereof are listed such as the diphenylethers with acifluorfen, bifenox, oxyfluorfen and lactofen as typical representatives; the imides with carfentrazone, fluthiacet-methyl and the aryluracils as preferred imide type herbicides; the N-phenylpyrazoles with nipyraclufen as typical representative; and phenyl- and

pyridyl-pyrazoles as particularly useful selective agents for the thus-engineered plants, plant tissue or plant cells described above.

Volrath et al. are silent on the combination of its listed structural classes of protox inhibitors and their representatives with other co-herbicides. Consequently, this reference too fails to suggest any surprising, unexpected effects on weeds and protox inhibitor tolerant crops associated with the combined use of the listed protox inhibitors and co-herbicides.

Devine et al. describe nitrodiphenylether and similarly acting structurally unrelated herbicides as protoporphyrinogen-oxidase (PPG-oxidase) inhibitors, and chloroplast and mitochondrial enzyme PPG-oxidase as their molecular target site. A detailed description of the prolonged research efforts under artificial conditions is given, e.g., by studying the interactions between said herbicides and other inhibitors of known subcellular inhibition sites, e.g., the photosystem II, or carotenoid or chloroplast biosynthesis in order to elucidate the molecular enzyme target of said nitrodiphenylether herbicides.

Further, the light-dependent sequence of damage during herbicidal action of cucumber cotyledons exposed to strong light is listed too and other modes of action of nitrodiphenylether herbicides by interfering with mitochondrial electron transport systems.

In the long list of antagonistic interactions of nitrodiphenylethers with inhibitors of known inhibition sites (Table 8.4), the interaction with tentoxin, a chloroplast biogenesis inhibitor model compound without any agrochemical significance, produces the one and only inhibition with a strong synergism in the 'in vitro' system. For the one skilled in the art this is not at all encouraging and leads away from instantly claimed economically relevant surprising effects. Moreover, Devine et al state on page 158, lines 4-2 from the bottom: "The long list (Table 8.4) and extensive discussion of interactions illustrates the difficult (and sometimes erroneous) route to elucidating a molecular site of herbicide action."

Devine et al. by giving a historical glance backward at the prolonged research efforts to elucidate the mode of action of nitrodiphenylethers and similarly acting structurally unrelated herbicides fails too to suggest any surprising, unexpected and economically relevant effects on weeds and crops associated with the combined use of its nitrodiphenylethers and co-herbicides.

In view of above, it is summarized that the cited documents neither per se nor in combination are providing any motivation to combine PPO inhibitors and co-herbicides in order to arrive at the surprising effects on weeds and protox inhibitor tolerant crop plants according to instant invention. There is nothing in the cited documents, neither taken alone nor in combination, which puts the present invention in the hands of the one of ordinary skill in the art. Sato et al. is the only document exemplifying protox inhibitors (carfentrazone-ethyl) in combination with co-herbicides (glyphosate) however without any hint to the surprising effects of such combinations as

instantly claimed. The deficiencies of the primary reference Sato et al. are not remedied by the secondary references Volrath et al and Devine et al. The cited documents constitute no more than remote state of the art, which is not useful for the understanding of the claimed invention. Moreover, the cited references are unrelated to each other and to instantly claimed subject matter.

The subject matter as claimed in instant claims thus remains unobvious over the combined teachings of Sato et al, Volrath et al and Devine et al.

Declaration under 37 C.F.R. 132 by Daniel North

In order to provide support for the useful enhanced herbicidal efficacy of the compositions according to the instant invention, a Declaration of Daniel North is submitted herewith. Said Declaration, based on the Colby equation, demonstrates the synergistic effects of the instant mixtures.

Please note that in addition to the tested weed Echinochloa crus-galli, the crop species maize 'DK-554 WT' (wild-type maize) and maize 'MHT 152 GMO' (GMO maize) also have been incorporated into the test.

It should be stated that the data shown in the Declaration were obtained from the treatment of 4 test plants.

As it is evident from Table 1 of the Declaration, the Compound of the formula A taken separately has a significant and economically relevant phytotoxic action on wild-type maize 'DK-554 WT' of 60 % and a weak but economically still relevant phytotoxic action of 20 % on GMO maize 'MHT 152' at the measured application rate of 12 g/ha. This phytotoxic effect on the crop plants is from the economic viewpoint intolerable and leads to retardation of crop growth and lastly to substantial loss of harvest.

The single Compound of the formula A at said measured application rate has very pronounced but economically insufficient activity against the weed Echinochloa crus-galli (rating 70 %).

On the other hand, the co-herbicides (S)-Metolachlor, Atrazine, Nicosulfuron and Mesotrione taken alone and both of the 2-components mixtures (S)-Metolachlor + Atrazine and (S)-Metolachlor + Mesotrione cannot control effectively the weed Echinochloa crus-galli at the measured application rates (ratings 0-60 %), and said co-herbicides taken separately have no phytotoxic activity against the 2 crop species wild-type and GMO maize or weak phytotoxic activity if combined in 2-components mixtures (ratings 10% and 20 %).

Surprisingly however, as is evident from Table 2 of the Declaration all the inventive 2-components mixtures with Compound of the formula A and the listed single co-herbicides and 2-components mixtures of co-herbicides synergistically reduces the phytotoxic effect on GMO maize

(but not on wild-type maize) to ratings of 0-10 % at the measured application rates, and simultaneously synergistically enhances the herbicidal action against Echinochloa crus-galli at the measured application rates (ratings 80-98 %).

This surprising twofold synergistic effect, namely

a) in connection with GMO crop selectivity, and


b) in connection with herbicidal activity

of the combination of the Compound of the formula A and the co-herbicides (S)-Metolachlor, Atrazine, Nicosulfuron or Mesotrione, or the 2-components mixtures of (S)-Metolachlor + Atrazine or (S)-Metolachlor + Mesotrione is unexpected. The obtained herbicidal improvements of the instant combinations are in this order of magnitude surprising to the one skilled in the art.

In view of the above amendments, arguments, deficiencies of the prior art and the results submitted in the enclosed Declaration under Rule 132, Applicants respectfully submit that the rejections under 35 U.S.C. §§ 103(a) and 112 have been overcome and hereby request that this application be passed to issue.

Respectfully submitted,

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VERSION WITH MARKINGS TO SHOW CHANGES MADE

In the claims:

1.(Amended) A herbicidal synergistic composition for the selective control of broad-leaved weeds and grasses in crops of useful plants resistant to protoporphyrinogen oxidase inhibitors, comprising, in addition to customary inert formulation auxiliaries, as active compounds a mixture of

a) a herbicide which inhibits the action of protoporphyrinogen oxidases and

b) at least one further pesticide selected from the group consisting of co-herbicides, fungicides and insecticides/~~[parasites]~~ acaracides.

10.(Amended) A herbicidal composition according to claim 9, comprising as additional component

c) a safener of the benzoxazin type, [~~in particular benoxacor, or~~] MON 4660, flurazole, dichlormid or furilazole.